5. InterdisziplinärerWorkshop KognitiveSysteme

Driver Behaviour Prediction at Roundabouts: Results from a Field Study

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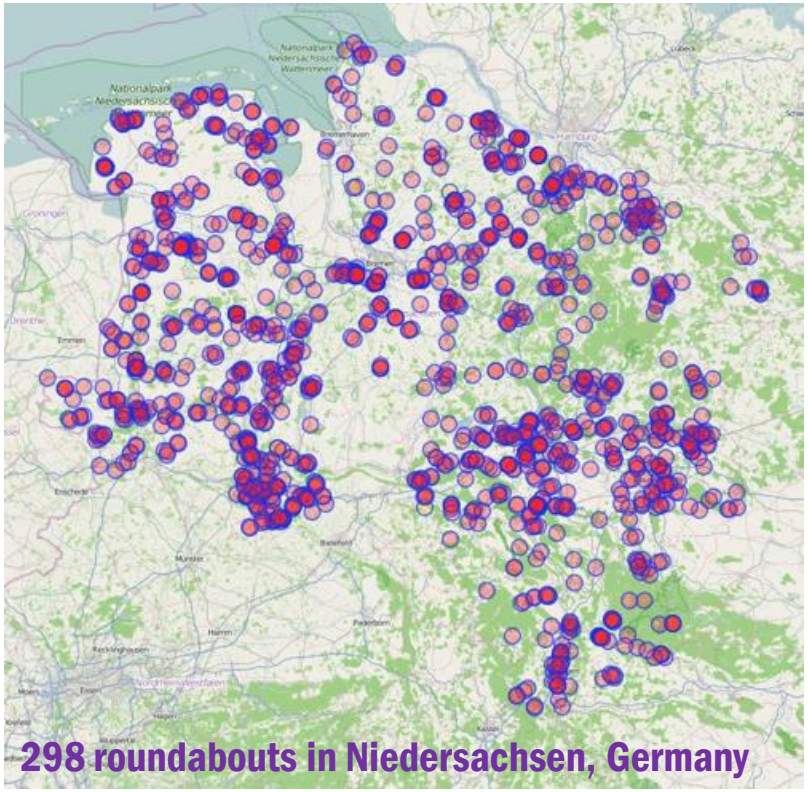
Agenda

1. Motivation and objective
2. State of the art
3. Methodology
4. Field study and results
   - data preprocessing
   - data exploration and behaviour classification
5. Conclusion and future work

Motivation

Roundabouts:

- Increasing number of roundabouts
- Crashes at roundabouts



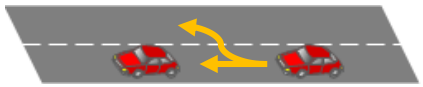
Objective

driver behaviour prediction:

take the exit or not

State of the art

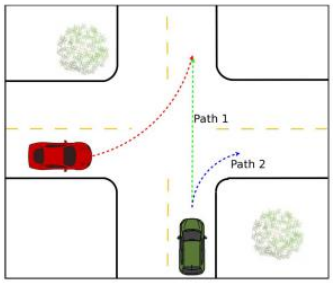
driver behaviour at section:



longitudinal control behaviour (lane changing/car-following)

- Hidden Markov Model (Pentland, 2000)
- machine learning techniques (Tango, 2009)
- Bayesian programming (Möbus, 2009)

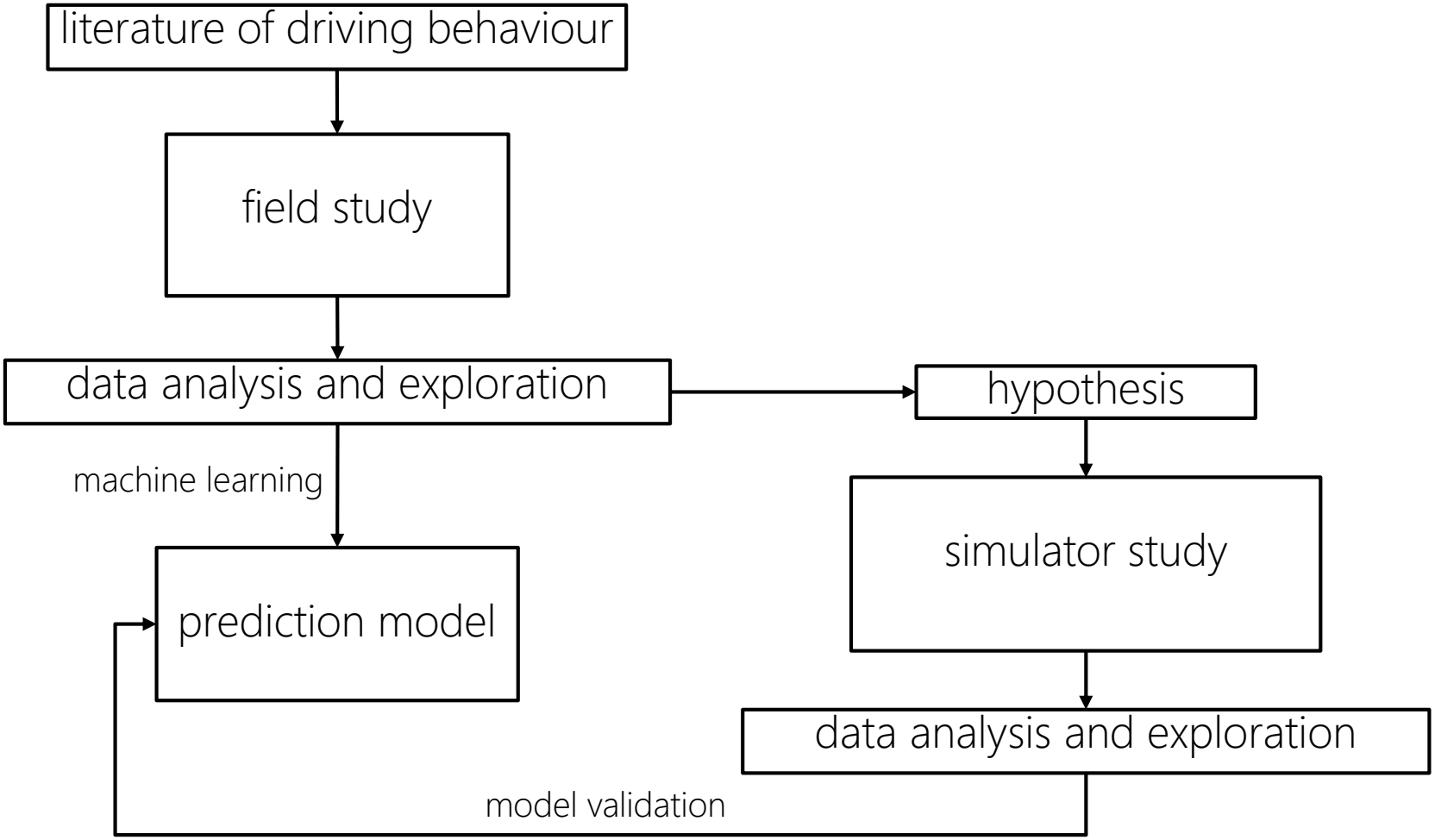
driver behaviour at intersection:



decision estimation

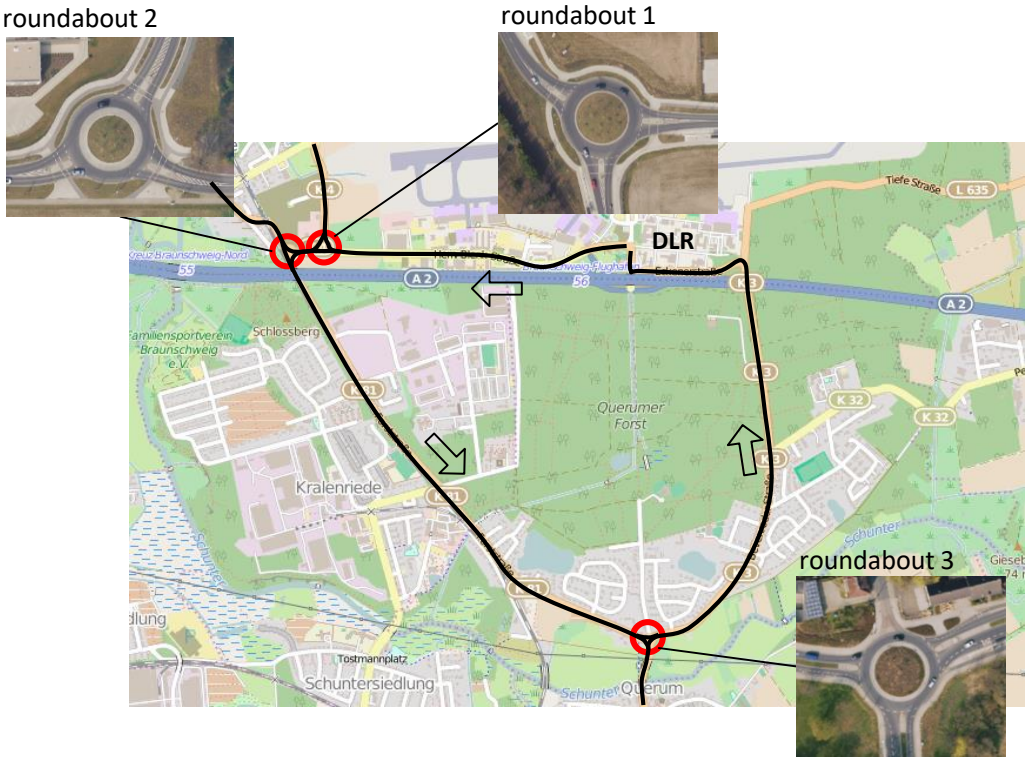
- Bayesian network (Lefèvre, 2011)
- K-means clustering (Naito, 2010)
- Hidden Markov Model (Gadepally, 2014)

Methodology



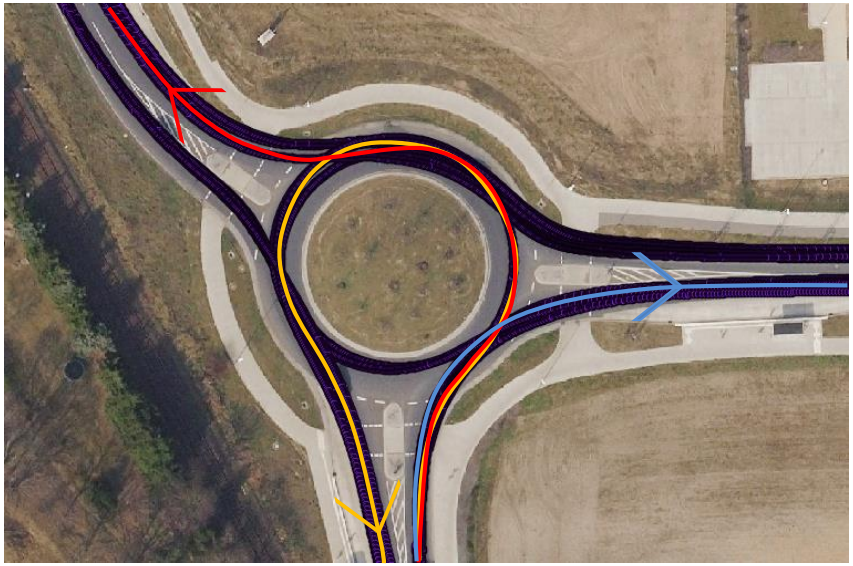
Field study

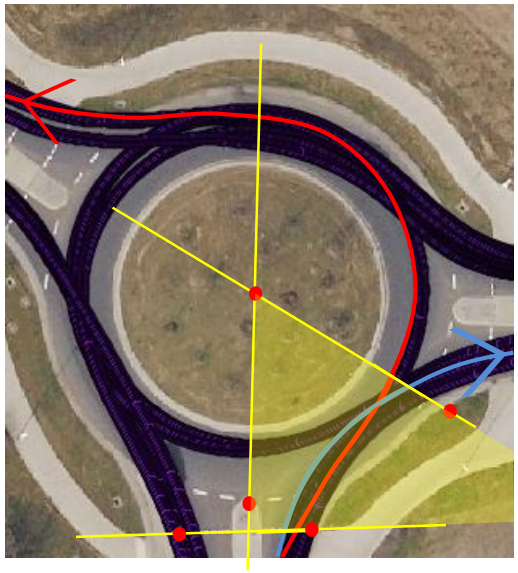
- seven participants
- ViewCar equippment
- Standardized driving route

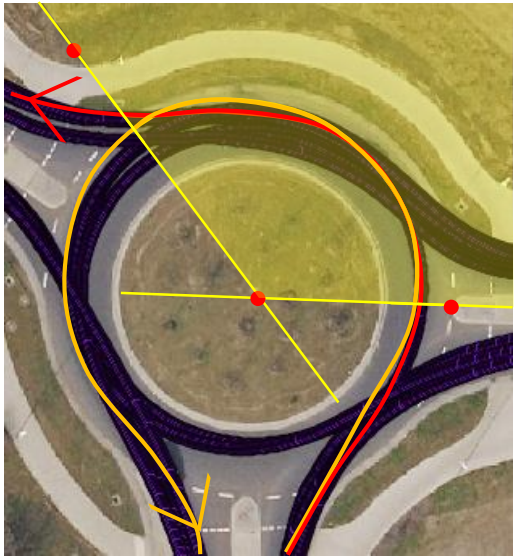


Data preprocessing

data selection:

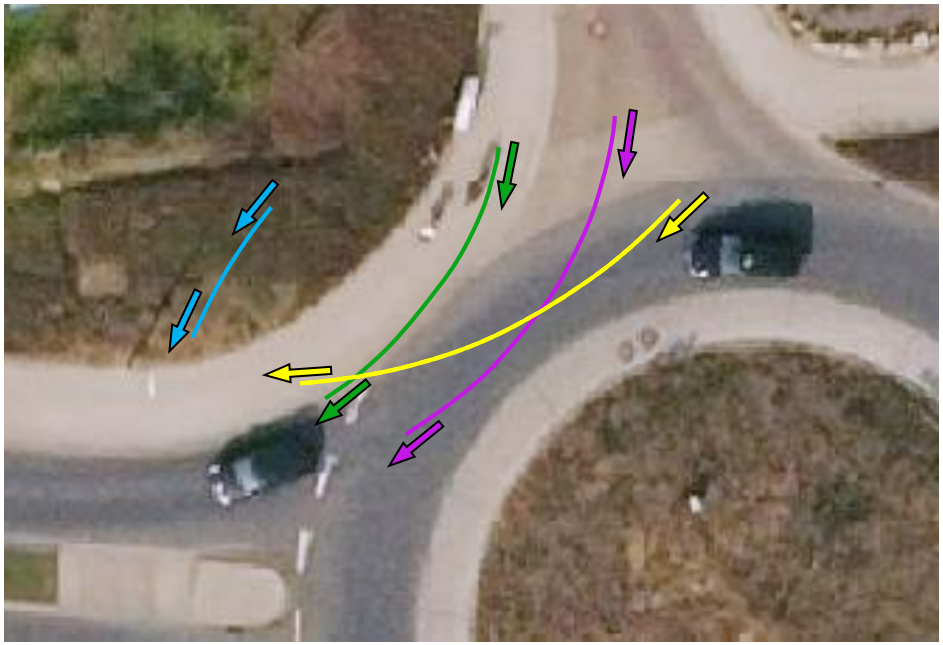


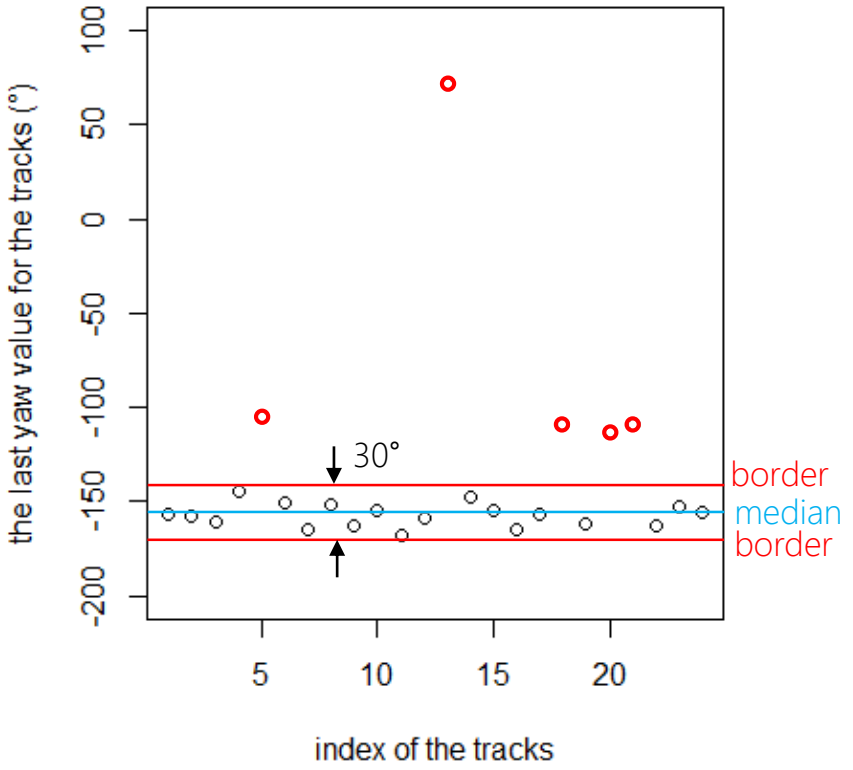




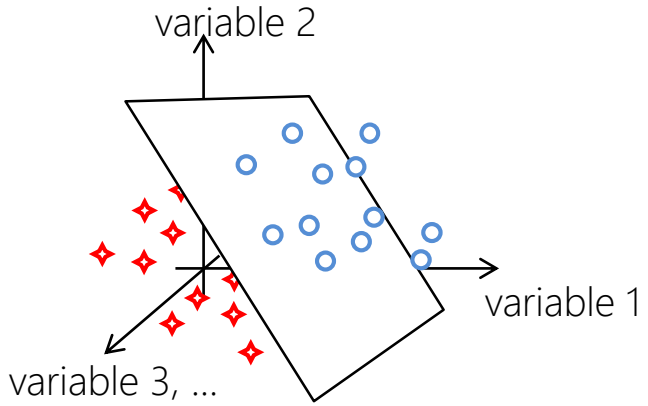
Data preprocessing

error data removal:





Classification with Support Vector Machine

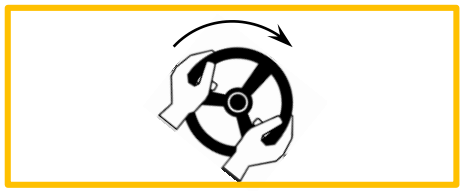


possible variables :

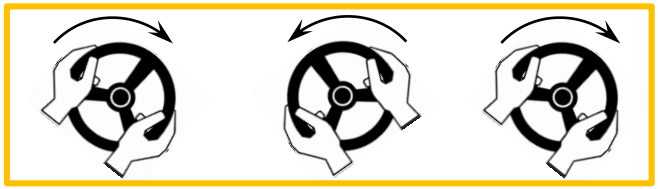
- velocity, acceleration
- indicator
- location
- yaw
- steering angle
- steering angle speed
- head motion, eye motion

Classification with Support Vector Machine

When entrance and exit are adjacent :



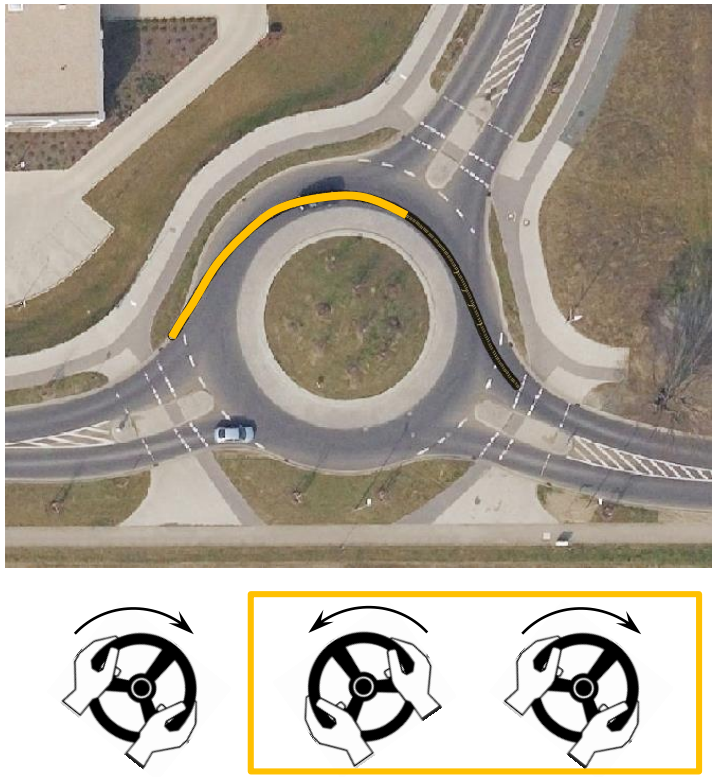
type 1



type 2

Classification with Support Vector Machine

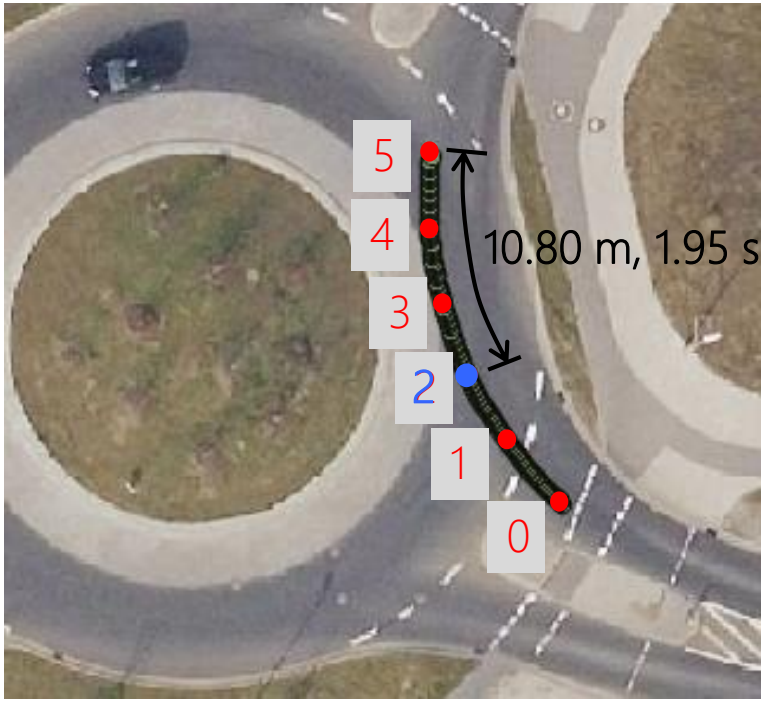
When entrance and exit are **not** adjacent :

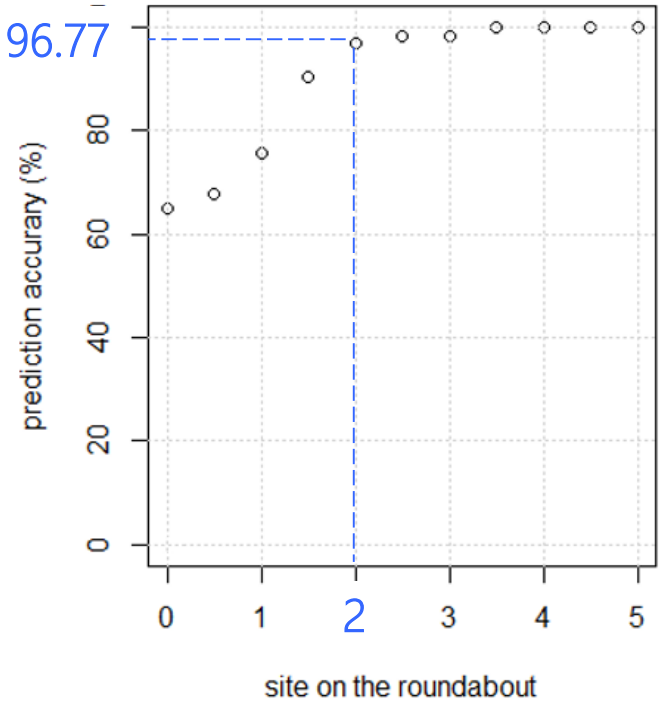


type 3

Classification with Support Vector Machine

result of prediction for type 1:

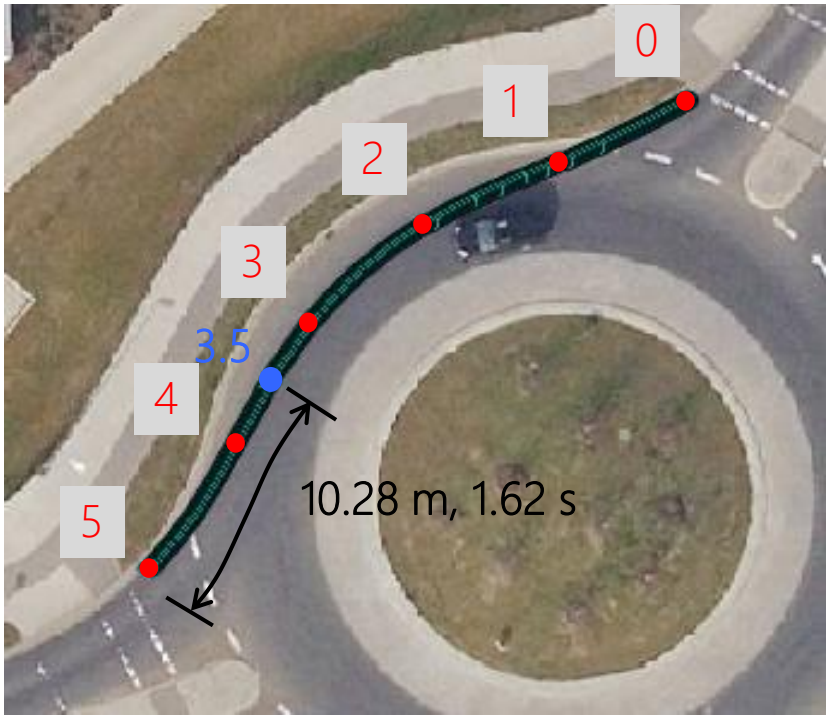


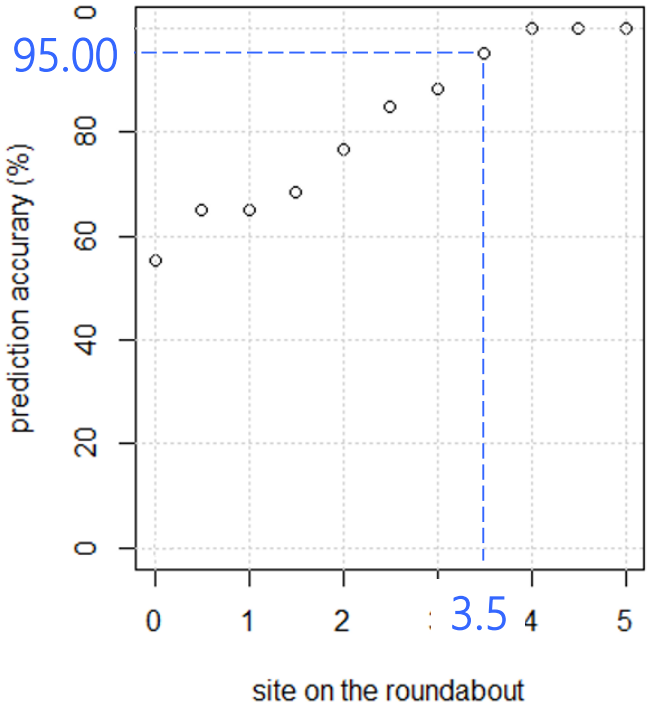


	label_prediction		
label_test		staying	leaving
	staying	42	0
	leaving	2	18
	hit rate	95.45%	100%

Classification with Support Vector Machine

result of prediction for type 2:

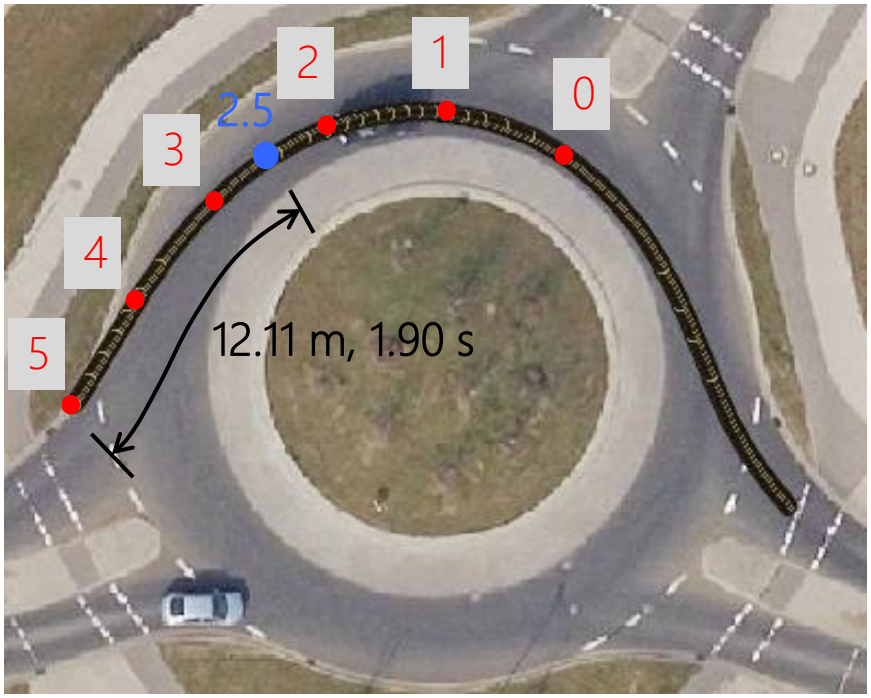


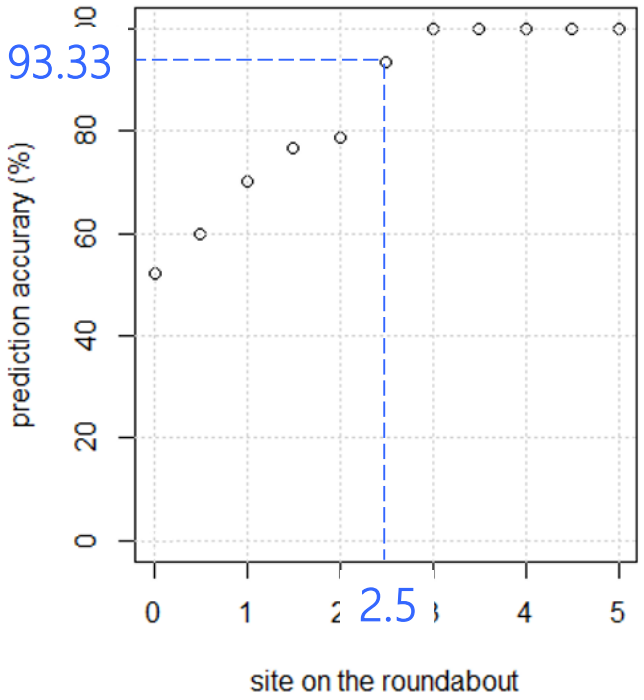


	label_prediction		
label_test		staying	leaving
	Staying	38	1
	leaving	2	19
	hit rate	95.00%	95.00%

Classification with Support Vector Machine

result of prediction for type 3:





	label_prediction		
label_test		staying	leaving
	staying	40	1
	leaving	5	44
	hit rate	**88.89%**	**97.78%**

DLR

Sumary of the field study :

- status of steering wheel for prediction
- prediction accuracy – above 90%, c.a.10 m away from exit

Open questions

- Online prediction
- Driver behaviours ⟷ roundabout geometry

Future work:

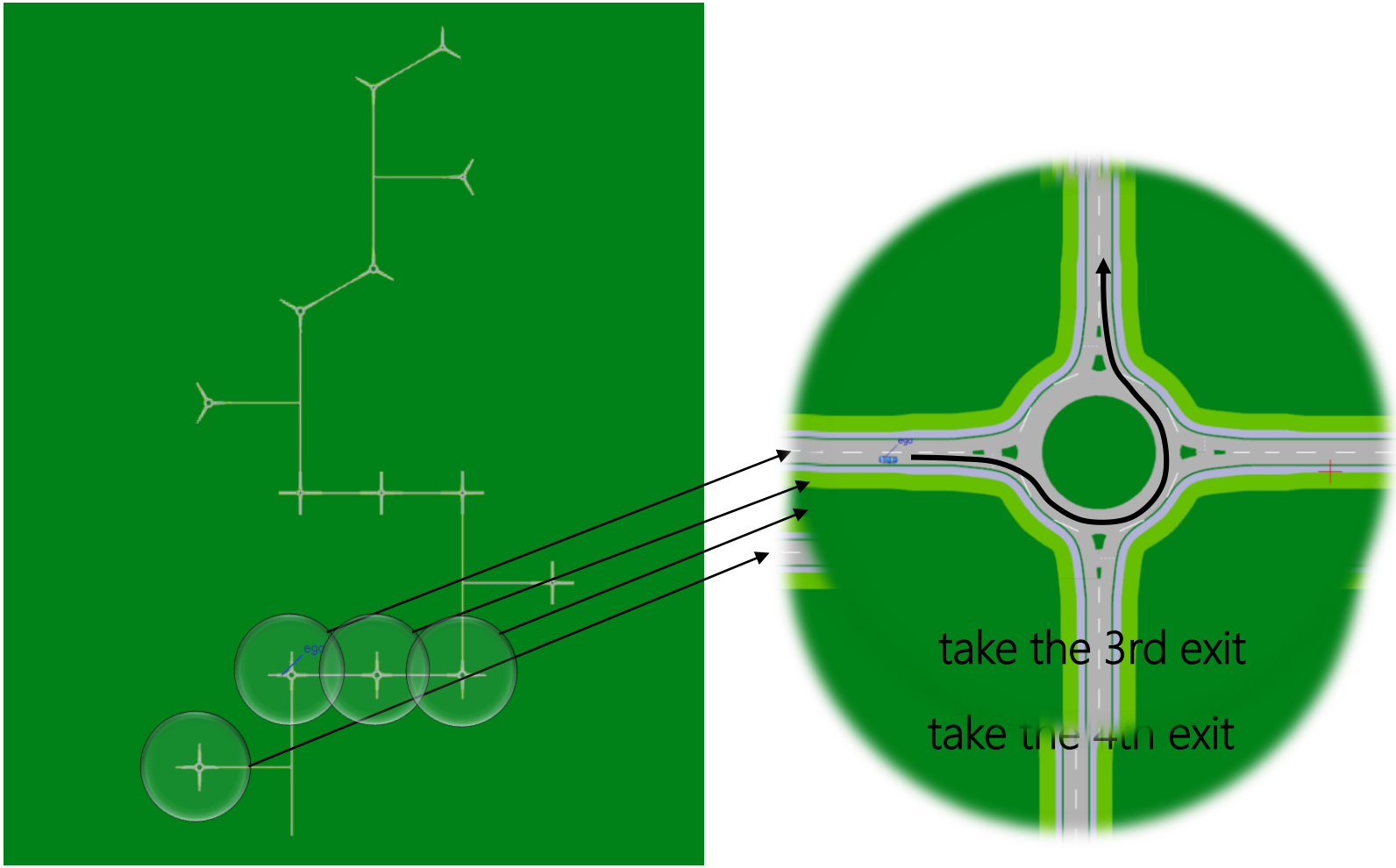
- Hidden Markov Models for behavior prediction
- Simulator study

Simulator study design

roundabout geometry:

- angle between exits (3-arm, 4-arm)
- diameter (25 m, 40 m)

Simulator study design



Thanks for your attention!